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ASTHENOPIA, OR WEAK SIGHT,

READ BEFORE THE
MEDICAL ASSOCIATION

OF CENTRAL NEW YORK,

AT THE ANNUAL SESSION HELD AT ROCHESTER, JUNE, 1869.

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COUNTY AND CITY MEDICAL SOCIETIES, ETC.

[REPRINTED FROM THE NEW YORK MEDICAL JOURNAL, APRIL, 1870.]

OSWEGO:
C. MORRISON & CO., PRINTERS.
1870.

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ASTHENOPIA, OR WEAK SIGHT.

By EDWARD M. CURTIS, M. D., OSWEGO, N. Y.

THE fact that cases of asthenopia are continually occurring in the practice of every physician, and that till recently its manifestations have been so little understood, is my excuse for occupying the time of this Society for a few moments in its discussion. We can all remember how often a patient has come to us whose eyes appeared as clear and bright as one could wish, yet their unhappy possessor would give utterance to a string of bad symptoms so long that we were either much annoyed and considered them as only the sickly fancies of a nervous mind, and sent him away with the sage information that he was growing old; or we became really alarmed, and advised him that it was *probably* an affection of the optic nerve or retina, a commencing glaucoma or amaurosis, and, unless he gave the weakly member rest, some terrible evil, as vague as it was uncertain, would surely overtake him—advice which, though excellent as far as it went, was wholly inadequate to free him from the trouble, yet, with the exception of general tonics, when required, this was all that we were able to do, till Helmholtz, Donders, Stellwag, and others, by the aid of the ophthalmoscope and ophthalmometer, made important discoveries in regard to the refraction and accommodation of the human eye.

Asthenopia may be divided into three varieties—retinal, accommodative, and muscular ; and a patient with weak sight may be troubled with one or all of them.

When the reflection of the images of surrounding objects upon the retina causes pain or an uncomfortable sensation, we have the retinal variety, which is at its height in severe cases of photophobia (or intolerance of light); mild examples occur in connection with the accommodative and muscular forms about to be described.

By accommodation, as applied to optics, we understand that change which takes place in the dioptric media (the cornea, aqueous humor, crystalline lens, and vitreous humor) that enables us to see objects at different distances with distinctness. The emmetropic (or normal eye) is so constructed that when at rest only parallel rays of light are brought to a focus upon the retina ; a moments thought will convince one that strictly parallel rays do not exist, as rays of light always diverge from their source, yet the rays, striking the eye, which emanate or are reflected from an object eighteen or more feet distant are so nearly parallel, that, for all practical purposes, they may be called such, and in optics they are considered as having the same relative direction as though they emanated from an object at infinite distances like the fixed stars. From this we understand that when observing an object more than eighteen feet distant the normal eye is at rest, but if the object be brought nearer to the eye than eighteen feet, those rays from it which pass through the pupil become more divergent, and the nearer the object is brought, the more divergent do those rays become ; now as only parallel rays are brought to a focus on the retina, in order to see a near object distinctly, it becomes necessary that some change should take place in the dioptric media sufficient to deflect these divergent rays in a similar direction to those which are parallel, in order that a clear image may be produced upon the retina. To produce this necessary refraction, the whole eyeball, or some part of its dioptric media, must be so under the control of the will that its convexity may be increased

and diminished at pleasure ; how this was accomplished has not been understood till recently. The convexity of the whole eyeball was thought to be changed by the action of the external muscles, but, in cases where the recti and oblique muscles are all paralyzed, accommodation may remain unimpaired, as has been proven by a case at Von Graefe's clinique. Helmholtz has shown by measurement with the ophthalmometer that the curvature of the cornea does not change ; that the iris is not the active agent is proven by cases of irideremia (or congenital absence of the iris), and also by cases that have occurred in the practice of Graefe and others, where the whole iris has been removed; but it has finally become definitely settled by experiment with the ophthalmometer upon Albinos, and cases of irideremia conducted by Cramer and Helmholtz—though entirely independent of each other—that this change of convexity takes place in the *crystalline lens* by the action upon it of the ciliary muscle. This muscle takes its rise from the posterior wall of the canal of Schlemm, forms the connecting link between the choroid and iris in the median tunic of the eye, and is in connection with the lens through the ciliary process and zonula of Zinn. Now, in the accommodative form of asthenopia, this ciliary muscle has become so weakened by overuse or disease, that it is unable to contract sufficiently to keep up the necessary convexity of the lens to enable the patient to view near objects for any length of time.

This is the most frequent form of the disease. Patients complain that, after reading or doing any close work for a few moments, objects become blurred and indistinct; this is on account of the exhaustion of the ciliary muscle; it is too weak to keep up its contraction; it relaxes, the lens becomes less convex, the rays of light from objects observed are brought to a focus behind the retina, on which circles of dispersion are formed, and, as a consequence, the outlines of objects are blurred. If the employment is continued, supra-orbital and temporal pain intervenes, the eyes feel full and watery, the conjunctival and sclerotical vessels become somewhat con-

gested, and dazzling, general headache, dizziness, and even nausea may occur, and the patient is wholly unable to engage at close work for a long time, and may be quite intolerant of light. These are the symptoms of the more aggravated cases; but in practice we meet with every gradation, down to the mere heaviness and blurring of the eyes, that all of us have experienced after having read too long by a bad light, and which is merely an admonition that we are overburdening our ciliary muscles, are straining our accommodation.

In muscular asthenopia, or insufficiency of the internal recti, those muscles are too weak to keep up the necessary convergence requisite to secure perfect binocular vision for near objects. In normally-constructed eyes, there is always formed a separate image of the object perceived on the retina of each eye, and it is necessary that these images should be formed on similar parts of each retina, in order that a sensation of but one object may be conveyed to the brain, otherwise we get diplopia (or double sight). In looking at distant objects, the muscles of normally-constructed eyes are at rest, and images are formed on the same part of each retina; but, to accomplish this, in viewing near objects, it is necessary that the optic axes should be strongly converged, which can only be done by the contraction of the internal recti muscles. Now, if these muscles have become weakened from any cause, their strength is then insufficient to keep up this convergence for a great length of time. They relax; the optic axes become parallel; the images are thrown on dissimilar parts of the two retina, and, as a consequence, diplopia takes place. The patient, who, for instance, is reading, does not complain of blurring, but that the letters seem to run into each other. The other subjective symptoms are much the same as in the accommodative form of the disease, but are sometimes more severe; but, by direct examination, the following train of objective symptoms is disclosed: Direct the patient to observe the point of a pencil which you approach toward him in the horizontal and median plane of his eyes. When within about six inches, one—or, if both internal recti are insuffi-

cient, each—eye will become uncertain in its fixation, will waver, and finally one of them will deviate outward. The same thing occurs if, after intently regarding a near object for a few moments, a screen be passed before one eye; but this deviation is made still more manifest by holding a prism with its base upward or downward before one eye; this will cause diplopia, and the two images, if the recti muscles are normal, will be one above the other in the same perpendicular plane; but, if there be insufficiency of these muscles, the images will still retain their relative distance one above the other, but will be also separated laterally, and be crossed—that is, the image formed upon the right retina will be seen at the left of the other, and *vice versa*. This lateral deviation may be corrected by another prism placed in front of the first, with its base inward, the two images being brought again into the same perpendicular plane; and the size of the angle of this correcting prism is the true measure in degrees of the amount of the insufficiency of the muscles.

Asthenopia is scarcely ever congenital; but the circumstances which give rise to the disease may be so. The retinal variety, except in the case of some Albinos, is always acquired, and is caused by exposure to too strong light, by an inflammation of some of the different structures of the eye, or by the dazzling of indistinct images in the other two forms of the disease. A fruitful cause of the accommodative variety is hypermetropia (a condition of the eye usually dependent on faulty conformation, the antero-posterior diameter of the ball being shorter than natural; as a consequence, parallel rays of light are brought to a focus behind the retina, on which circles of dispersion are formed, and the images of objects are blurred. To compensate for this, the lens is made more convex by the contraction of the ciliary muscle, and in that way parallel rays are properly focused upon the retina). The greater the amount of the hypermetropia—that is, the shorter the antero-posterior diameter of the ball—the greater must be the curvature of the lens and the consequent contraction of the ciliary muscle. This gives clear vision for

distant objects; but when the patient attempts to look at near objects, he must call out a still further contraction of this muscle equal in amount to that ordinarily expended by the emmetropic (or normal eye) in accommodation. During youth, while the lens is soft and plastic, this may be done without fatigue; but as the lens hardens by age, the muscle is not sufficiently strong to produce the necessary convexity, and symptoms of asthenopia are soon manifest; and this all the more early if the general muscular system has become weakened from any cause. The accommodation may become weakened to the extent of asthenopia, in the normal, and sometimes even in the myopic eye, by overuse, when the system is suffering from debility, familiar examples of which are the occasional cases of weak sight in women while nursing; patients, while convalescing from typhoid and scarlet fever; students and sewing-girls, who have overworked themselves, and have not been properly nourished; and these cases are always aggravated if there be present ever so little hypermetropia. Cases of astigmatism (that is, where there is a difference in the curvature of the cornea in different meridians) are always asthenopic; and, although primarily due to imperfect refraction of light by the cornea, are, in a measure, dependent on an irritable ciliary muscle. Insufficiency of the internal recti occurs most often in cases of myopia, as this error of refraction necessitates objects being brought so near that a much greater effort at convergence is required than with the normal eye; consequently these muscles become overburdened and enervated. It may also occur in the normal and in the hypermetropic eye, in connection with the accommodative form. According to Knapp and Kugel, cases of asthenopia, dependent upon insufficiency of the external recti muscle, sometimes occur; but they are so infrequent as to have excited little attention.

Stellwag sets it down as an axiom that asthenopia can be cured; better authority we could not wish. In promoting this cure, the first indication—as in other diseases—is to remove the cause. If, in the retinal variety, the photophobia

has been caused by iritis, by iridochoroiditis, or by retinitis, the inflammation must, of course, be combated by appropriate treatment. If the patient has been exposed to too strong and brilliant light, that cause must also be removed. If it has occurred from the blurring and dazzling concomitant upon the accommodative and muscular varieties, the means that are successful in removing these latter will relieve the over-stimulated retina.

We have always in asthenopia to look to the general health of our patients; and, in the great majority of cases, they will be found anæmic. Tonics are, of course, indicated; and strict hygienic and dietetic rules must be observed. Constitutional treatment alone, however, is not sufficient, if there be an abnormal conformation of the eyes, or if the patient's accommodative or recti muscles have become weakened by over-use; but if, in the case of the overburdened ciliary muscle, we place a weak convex glass before the eye, we relieve the muscle of just so much contractile power as it would take to cause a convexity of the crystalline lens equal in amount to the refraction of the glass used. The strength of the glass will vary with the case; in hypermetropia, the greater the amount of the error of refraction, the stronger must be the glass; and if the hypermetropia be absolute—that is, the ciliary muscle too weak to focus parallel rays upon the retina—glasses must be used for distant as well as for near objects; but in low grades of hypermetropia and for the emmetropic eye, weak convex glasses, for near objects only, are required; and in myopia, where strong concave glasses are used for distance, weak concaves may be necessary for near work.

Insufficiency of the internal recti may also be benefitted by the use of weak convex glasses. This is owing to the dependence existing between the act of convergence and that of accommodation; if the latter be relaxed, the tension upon the internal recti is also lessened. These muscles may also be relieved by prismatic glasses, with their bases turned inward,

the strength of the prism not to exceed the degree of the insufficiency of the muscles; and they may be strengthened by regular exercise for a short time at stated intervals, with prisms whose bases are turned outward. But, when the insufficiency is extreme, and has been of long duration, division of one or both external recti becomes necessary, after which the proper use of glasses will accomplish a cure. Frequently we find cases where the recti and ciliary muscles are both weakened, and they may require prismatic glasses, one side of which is ground convex—the prisms, to neutralize the insufficiency of the internal recti, and the convexity to relieve the ciliary muscle. But, in practice, it has been found that no one thing conduces so much to the relief of patients suffering from asthenopia as to strengthen and give tone to the weakened muscles by a course of gymnastic exercises taken at regular intervals, as was first proposed by Dyer, of Philadelphia. Having first given the patient those glasses best calculated to relieve the excessive muscular contraction—being careful, however, that they are not too strong—require him to use them at reading or at close work, once in the morning, and once during the afternoon of each day. The first day to read only three or four minutes at a time, and to increase the time by only one minute each consecutive day; and, should the case be very severe, an increase of one minute every other day would be sufficient. When the patient has reached a time above fifteen minutes, he should rest five minutes after every quarter of an hour that he reads, and then proceed until the proper time has been completed; but the exact time should never be exceeded, as in that case there would be danger that the exercise would weaken rather than strengthen the muscles.

Why the diseases of so important an organ as the eye should receive so little attention from the majority of the profession; why they should be considered a sort of Scylla, whose Charybdis, the diseases of the ear, it was only equally necessary to steer clear from; why patients, suffering from them, should be left to the tender mercies of traveling char-

latans and patent collyria, is hard to conceive. Certain it is that, since the discovery of the ophthalmoscope, there is no one class of diseases so easily and surely diagnosticated, and about which so certain a prognosis may be indicated, as these same troubles of the eye; and, in regard to asthenopia, though the directions given in this paper may seem dry and hard of application, yet there is not one of us, if he be willing to give a little time to their study, a little practice to their details, but what would find them easily acquired, and would feel amply repaid by the relief and benefit he would confer upon his patients.

The following cases from the author's practice have been added to the original paper, for the purpose of illustrating the treatment of asthenopia:

January 2d, 1868.—Miss E——, aged 28, a seamstress; general health good; had never had trouble with eyes until within the last three months; for more than a year had sewed on an average twelve hours a day, but lately had been obliged to lay aside her work after sewing a short time during the day, and to give it up entirely at night on account of blurring, dizziness, and severe pain through the eyes and temples. The eyes appeared natural, and she could read No. 20 of Snellings test type at 20 feet with either eye—that is to say, for distant objects her sight seemed normal—but on attempting to read No. 2 of Snellen at two feet, the type soon became blurred and pain supervened; but with No. 30 convex glasses she was able to read the finest print with apparent ease. On paralyzing the accommodation with atropine she could only read No. 20 at 20 feet with convex 24 glasses, showing that amount of latent hypermetropia, undoubtedly the predisposing cause of the asthenopia. She was directed to take a few weeks rest, and to use No. 30 convex glasses when at close work.

I saw her six months after; she was again hard at work and had no trouble unless she attempted to sew without the glasses.

February 12th, 1868.—Mrs. M——, aged 21, sent to me by a neighboring practitioner. Had a child sixteen months old which she had not weaned, though advised to do so by her attending physician; was weak and anemic, and she was excreting a large amount of the phosphates; had been taking iron and bark with some little benefit to general health. Had had severe asthenopic symptoms for last six months so as to be unable to read or sew for more than a few moments at a time. Sight was good for distant objects and there was no manifest hypermetropia, for though she could read No. 20 of Snellen at 20 feet, she could not do so through convex 40's. By the use of weak convex glasses she could read ordinary print a little longer and easier than without them. The use of prisms showed only an insufficiency of the internal recti, so slight as to be corrected by a prism of 2° ; the use of atropine disclosed only a slight amount of hypermetropia, not sufficient in itself to account for her trouble; and the ophthalmoscope showed nothing abnormal in the fundus of either eye. This, therefore, seemed a clear case of accommodative asthenopia, or weakness of the ciliary muscles, and as such was treated. She was directed to wean the child, to continue the tonics, was given strict dietetic and hygienic rules, especially in regard to out of door exercise, and a pair of convex 30's to use after Dyer's method.

I did not see her again till July 20th, when she appeared much improved, was able to read or sew with her glasses for an hour at a time without fatigue, and her general health seemed good. Was directed to read for a few moments each day without glasses, but to stop on the slightest symptom of fatigue.

January 4th, 1869.—She called on me to state her entire recovery. She had not used the glasses for the last two months and her eyes seemed as strong as ever.

April 3d, 1868.—Mr. H——, aged 19; was sent to me by Dr. Agnew, of New York; had been a hard student for the last two years, sitting up late of nights to read, general health

was much impaired; he could not bear the sun light and could not read a moment without suffering pain; the Doctor stated that he found 15° of insufficiency of the internal recti, and a slight amount of manifest hypermetropia. He recommended strict attention to general health, that the patient should take iron and strychnia, and use Dyer's method of calisthenic exercise, with a light pair of convex glasses. I verified the diagnosis and carried out the treatment as recommended, being careful that he should be much of the time in the open air, though the photophobia was so great that for several weeks he was obliged to wear blue glasses. The improvement was gradual, retarded, I think, by the young man's discontent at being obliged to give up his studies, but at the end of six months he was able to read four hours a day by the aid of his glasses, and his general health was much better. I saw no more of this case, and suppose for that reason, that he continued to improve.

May 19th, 1868.—Miss A——, aged 20; had always been nearsighted; had worn glasses for distant objects for eight years; recently her general health had failed; she was troubled by diplopia so much that she was unable to read or practice her music; the notes and letters all appeared double, were surrounded by a "haze," and if she persisted in reading the more severe asthenopic symptoms came on, accompanied by an apparent internal strabismus; her glasses, concave 5's, increased the diplopia, and did not benefit her sight; with them she could only discern No. 100 Snellen, at twenty feet—that is, they only gave her one-fifth of normal sight. By the usual tests it was found that she was astigmatic (a difference of the curvature of the cornea in different meridians) as well as myopic, and by combining cylindrical with concave glasses so as to form a lens, one side of which was ground with a spherical concave surface (like the ordinary concave glasses) of 20 inches focus; the other side a cylindrical concave surface 24 inch focus, the axis of the cylinder horizontal (to compensate for the mal-formation of the cornea), she could see distant objects clearly, and could read No. 20 at twenty

feet; the diplopia and squint disappeared, and she exclaimed with delight that she had never seen plainly before; with No. 48 cylindrical concave glasses she could read the finest print plainly for a short time, and by gradually increasing the time and under the use of tonics, she came to use them freely.

The above cases were selected, as showing different but frequent types of this disease, which is so multiform in its manifestations, as often to simulate other and graver troubles, yet is sometimes so easily and simply cured that patients wonder how they could have remained in discomfort so long.

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